東京大学大学院工学系研究科　総合研究機構

結晶界面工学研究室

Crystal Interface Laboratory, The University of Tokyo

Crystal Interface Lab. Seminar Series

SuperSTEM - probing materials one atom at a time

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An essential corollary to the exciting instrumentation developments electron microscopy has witnessed over the last decade is the significant increase in detection limits and signal-to-noise ratios achieved on the new generation aberration-corrected microscopes, which provide improved data collection ability and greater flexibility. The development of so-called 'gentle', dose-controlled STEM techniques, for instance, has been particularly beneficial for the field of two-dimensional materials: the examples of graphene and MoS_2 nano-catalysts studies will demonstrate how these structures can be imaged directly at atomic resolution with annular dark field (ADF) imaging while single atom impurities or defects can be chemically fingerprinted using spectroscopy (Fig. 1). In addition, the wealth of complementary analytical signals available from a single experiment provide unprecedented insights into the properties of materials. Recent applications include the first chemical images of dopant clustering in oxide nano-particles, direct evidence of interfacial charge transfer in solid-oxide fuel cell anodes and detailed structure determination of Nd-rich nanorods in doped $BiFeO_3$ (Fig. 2).

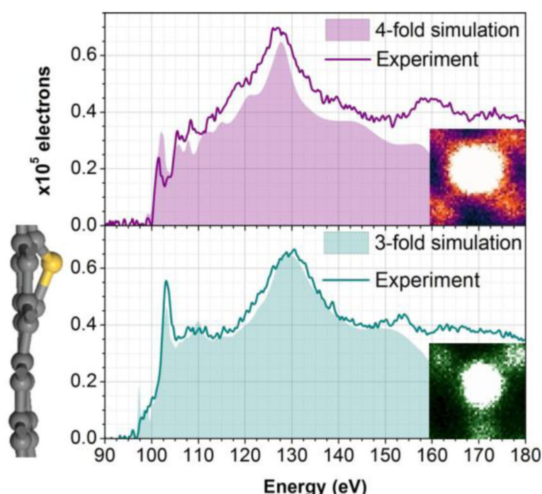

Fig. 1: *Experimental and simulated EELS spectra acquired from a single Si atom in graphene in two different bonding configurations. Q.M. Ramasse et al.,* Nano Letters, **2013,** *In press.*

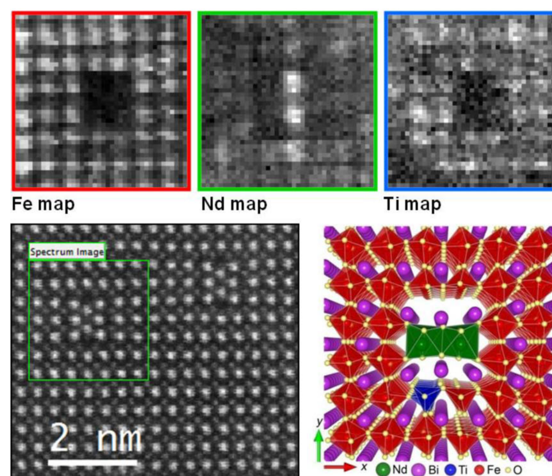

Fig. 2: *Atomic-resolution EELS maps of a rod-shaped defect in Ti/Nd co-doped $BiFeO_3$. HAADF/BF imaging and EELS are combined to propose the structural model. I. MacLaren et al.,* Adv. Fun. Mat., **2013**, *In press.*

Main meeting room at Institute of Engineering Innovation, UT

(工学部総合研究機構　９号館１階　大会議室)

2013, March 14th (Thu.) 10:00~11:30